STA 101: MATHEMATICS FOR BUSINESS AND SOCIAL SCIENCES I

FINAL EXAM NOVEMBER 2013

Time: 2 Hours **Max. Marks: 100**

Note: Answer Question 1 and ANY OTHER TWO Questions.

Question 1

a) Let R be the relation defined as "a is the additive inverse of a" on the set $A=\{2,-2,3,-3,1,-1\}$. Represent the relation by an arrow diagram.

b) Solve for t: $\dfrac{t^2-4}{t}=2$.

c) Simplify: $\log_4 32-\log_9 81+\log_2\sqrt{2}$.

d) Find the equation of a straight line passing through the point $(-3,-2)$ and perpendicular to the straight line $3x-2y+1=0$.

e) Solve the following inequality:

$$3-\frac{2}{x}\geq x$$

f) Given $A=\begin{bmatrix}-1 & 0\\ 1 & 2\end{bmatrix}, B=\begin{bmatrix}-1 & 2\\ 0 & -2\end{bmatrix}$ find $(AB)^T$.

g) Evaluate the following series:

$$\sum_{k=2}^{20}\left(2^k+3\right).$$

h) Solve the following system using Gauss-Jordan (Elementary Row Operation) method:

$$\begin{aligned}2x+y&=4\\ x+y&=3\end{aligned}$$

(8 x 5 marks)

Question 2

(a) Simplify completely: $\dfrac{x^2-4y^2}{4x+8y}\div\dfrac{x^2+4xy+4y^2}{x-2y}$.

(b) A farm in Pandamatenga has 100 acres of land available on which to grow maize and sorghum. The following table shows the cultivation costs per acre and the expected profit per acre. The column to the right shows the amount of money available for each of these expenses.

	Maize	Sorghum	Money available
Cultivation cost/acre	P40	P160	P1800
Labour cost/acre	P60	P60	P2400
Profit/acre	P200	P250	___

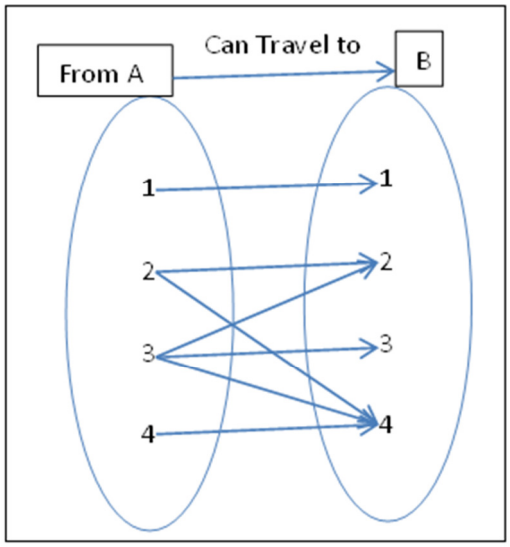
(i) Formulate the above information as a Linear Programming Problem (LPP).

(ii) Find the number of acres of each crop that should be planted to maximize profit.

(8+22 marks)

Question 3

a) All roads linking different neighborhoods in a certain city are one-way. The following arrow diagram shows how 4 such localities are linked.



(i) Write down the ordered pairs for the relations

(ii) Verify which of the properties of relations, namely: *Reflexive, Symmetric, Transitive and equivalence* are satisfied.

(4+11 = 15 marks)

b) Given that $A = \begin{pmatrix} 4 & 2 & 0 \\ 9 & 5 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ find (i) the determinant of A ,(ii) the inverse of A.

(5+10 = 15 marks)

Question 4

a) Solve the following for x,

i) $e^{2x}e^{5x} = e^{14}$ ii) $log_{10}(x+2)^2 = 2$

iii) Express $2logx - \frac{1}{2}\log(x-2)$ as a single logarithm.

b) CTO wishes to buy two types of tyres: type A and type B. CTO can buy two (2) type A tyres from Good Year tyres and one (1) type B tyres from Super tyres for a price of P24, 000 or CTO can buy three (3) type A tyres from Good Year and six (6) type B tyres from Super tyres for a price of P36,000. Formulate, but do not solve the problem, to find out the number of units of type A and type B tyres CTO wishes to buy in the form a system of linear equations.

c) Solve the following system of linear equations:

$$\begin{aligned} 2x+4y+6z &= 22 \\ 3x+8y+5z &= 27 \\ -x+y+2z &= 2 \end{aligned}$$

((3+5+4) +6+12=30 marks)

Question 5

(a) There are 20 terms in an Arithmetic Progression (AP). The sum of the first 10 terms is 55 and the sum of the last 10 terms is 355. Find (i) the first term, a_1 and (ii) the common difference, d.

(b) Find the sum of the first 10 terms of the series $\frac{1}{8}, \frac{1}{4}, \frac{1}{2}, \ldots$.

(c) A certain sum of money was invested at 15% simple interest per annum. If, in 3 years this earned an interest of $P450$, find the sum of money invested.

(d) How much money should John save in an account paying 6% interest compounded monthly if he wants to have $P60000$ in 2 years?

(e) Loverboy estimates that he will need $P300000$ in cash to buy his dream car in 6 years from now. How much should he deposit at the end of each month into an account which pays an interest of 12% per annum compounded monthly so that there will be enough money in the account at the end of 6 years?

(9+5+4+5+7=30 Marks)

END OF QUESTION PAPER!

GOOD LUCK!!